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APPLIANCE SERVICE TECHNOLOGY PROGRAMS.
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THIS IS AN OUTGROWTH OF A FEASIBILITY STUDY COMPLETED IN THE PREVIOUS YEAR (SEE JC 660 071). IT PROPOSES 1-YEAR AND 2-YEAR APPLIANCE SERVICE TECHNOLOGY PROGRAMS, BASIC COURSE OUTLINES, AND FACULTY NEEDS AND EQUIPMENT FOR THIS COLLEGE. EACH PROGRAM INCLUDES THE SUBAREAS OF COMMUNICATIONS SKILLS, BUSINESS PRINCIPLES AND PRACTICES, WARRANTIES, AND MATHEMATICS. CRITERIA FOR THE ESTABLISHMENT OF SUCH A PROGRAM AND A SUMMARY OF THE PROPOSALS ARE SUGGESTED. RECOMMENDATIONS INCLUDE (1) CLOSE COOPERATIVE ARTICULATION AMONG THE COLLEGE, THE HIGH SCHOOL, AND THE APPLIANCE INDUSTRY, (2) THE ESTABLISHMENT OF A SOUND FINANCIAL BASE, AND (3) THE INSTIGATION OF A PROMOTIONAL CAMPAIGN. THE FINAL PORTION OF THIS PROPOSAL CONTAINS THE CURRICULUM GUIDE FOR EACH OF THE TWO PROGRAMS, THE SUGGESTED EQUIPMENT LIST, AN INTEREST QUESTIONNAIRE FOR PROSPECTIVE EMPLOYERS, AND A LIST OF THE MEMBERS OF THE COMMITTEE. (JP)

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APPLIANCE SERVICE TECHNOLOGY PROGRAMS

Presented
by

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Lake Michigan College
711 Britain Avenue
Benton Harbor, Michigan
June 1966

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PREFACE

The proposed one- and two-year appliance service technology programs, suggested curricula guides, and suggestions for the establishment of a program, are considered to be phase II of the overall project supported by the W. K. Kellogg Foundation of Battle Creek, Michigan for the planning and implementation of an appliance service technology program at the post-high school level. The final phase of the project is to include final planning and the probable implementation of an appliance service technology program at Lake Michigan College of Benton Harbor, Michigan.

June 1966 C. H. S.

ACKNOWLEDGMENTS

Recognition and appreciation is expressed to: the W. K Kellogg Foundation for the financial support given this project; members of the Advisory Committee for their contributions and evaluations so important to this project; and the personnel in the appliance manufacturing and trade association organizations, distributor, retail and service organizations for their cooperation, suggestions and services.

Gratitude is also expressed to Mr. Einar Larson, Chairman of the Division of Business, and Mr. Edward West, Instructor of Electronics Technology, at Lake Michigan College for their suggestions in the formulation of the proposed programs.

To Mrs. Judy Schmid and Mrs. Annette Lake the writer expresses a special appreciation for their efforts and cooperation in the typing, assembly and mailings involved in this project.

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CHAPTER I

PURPOSE

A preliminary feasability study, completed in 1965, indicated an agreement between appliance manufacturers and associations and distributors, retailers, and appliance service organizations that there is a need for trained appliance service technicians. A concensus was derived that post-high school training is necessary in appliance service but some uncertainty was indicated whether a one-or two-year program is needed. Both programs are proposed in this writing.

The Purpose of the Report

The purpose of this report was to propose programs in Appliance Service Technology, basic course outlines, suggest facility needs, equipment, etc. to serve as a possible guideline in the establishment of appliance service technology programs in post-high school educational institutions. Some of the limitations of the proposed programs are: (1) that the philosophy of a given institution regarding the requirements in general education, skill subjects and cognate areas of instruction must be superimposed upon the program and then possible changes made to adapt the program to each training institution and community; (2) that the needs for trained appliance service technicians and the desired level and length of traning may vary from locale to locale; and (3) that disagreements may arise in textbook selection, space allocation, course content, course sequence, etc.

Definition of Terms

Appliance Service Technician.--A person that installs, diagnoses problems, repairs and rebuilds large and small appliances in homes and business establishments.

Appliance Service Technology.--A specialized training program in which the opportunity is presented for acquisition of basic information relating to the installation, repair and rebuilding of major and small appliances, customer relations and sales, and business operation techniques.

Organization of the Remainder of the Report

The rationale of the development of the proposed one-year program, and suggested facility and equipment needs for the establishment of the said program, is presented in chapter II. A similar presentation of rationale of program development proposed program, suggested facilities and equipment is summarized in chapter III for the two-year program. Suggested criteria for the establishment of a program in appliance service technology program are presented in chapter IV and the summary, conclusions and recommendations are presented in chapter V. Suggested curriculum guides for each course are presented in appendix A. Suggested equipment needs are outlined in appendix B and questionnaire samples for a study to determine the feasability of establishing a program are included in appendix C.

CHAPTER II

THE PROPOSED ONE-YEAR APPLIANCE SERVICE TECHNOLOGY PROGRAM

The proposed one-year appliance technician program was designed for high school graduates who possess an average, or better than average ability in mechanical reasoning and dexterity.

The rationale in the design of the one-year appliance service technology program was that a trainee in such a program should: (1) be literate in his communications with the public that he is to serve and would have adequate skills to effectively follow directions and communicate these directions to his superordinates, peers and subordinates; (2) be exposed to and become sufficiently proficient with the basic principles of business procedures and practices; (3) be familiar with warranties, service policies, etc. of the manufacturer on the product that he services and sells; (4) have an understanding of basic merchandising and warehousing techniques; (5) be aware of some of the basic principles of customer relations and relationships with other associates within a service organization; (6) be sufficiently proficient in the manipulative skills of mathematics to perform the normal business and service function of his organization or position; (7) be aware of the basic principles of electricity and have a basic skill to work with the electrical aspects of appliance installation and repair; (8) have a fundamental understanding of how and why an appliance performs the function for which it was designed through the basic laws of physics, chemistry, and the actions of basic mechanical and electrical mechanisms; and (9) have a proficiency developed in the installation, problem diagnosis and repair of major and small appliances in homes and business enterprises. As a result, the following ten broad subject areas were considered to be the most necessary for the training of an appliance service technician in a program of one-year duration.

Communications Skills

Since appliance service technicians may encounter a variety of problems and situations within their own service organization and the general public it becomes essential that such individuals possess some verbal and written skills. The necessity for letter, memo, report and other writing dedemand some writing skills while the verbal interactions between employees, supervisor-employees, and in public relations includes the need for verbal skills.

Even though it is recommended that the prospective trainee be at least a high school graduate, the need for review of the fundamentals of English grammar, spelling, punctuation, capitalization, etc. was deemed important. To build upon this basic review it is suggested that exercises in word usage, sentence structure, etc. be adopted after which exercises in personal and business letter writing should be given. The culmination of the writing skills section of the training program can be the report writing on laboratory experiments and appliance servicing which are the essentials of the position.

The spoken word is a very important part of the total development of communications skills. The ability, or lack of ability, in this area can help determine customer and public relations as well as the interpersonal relationships within a service organization. The introduction to both informal and formal speaking was considered an essential in this program. The basic principles and practices of effective speaking should be understood and the application of these basic principles and practices should be a part of the appliance service training program.

The suggested inclusion of the aforementioned communications skill training into the one-year program is herein proposed and a time allocation of at least 50 hours is suggested.

Business Principles and Practices

An Appliance Service Technician should have: (1) a basic understanding of the economic system upon which our business enterprise is founded and in which the service organization operates; (2) a fundamental knowledge of buying and selling, transporting of merchandise, storing, grading and financing, customer satisfaction, and profit; (3) the basic understanding of the accounting procedures and applications in recording, analyzing and interpreting the financial transactions of the organization; and (4) an introduction to, and understanding of, the needs and tools of salesmanship, the sales atmosphere, and the need for creative selling.

A suggested allocation of approximately 100 hours of instruction and problem exploration time in this area is herein proposed.

Warranties, Service Policies, etc.

A general concern was expressed by manufacturers and service organizations for an appliance service technician to understand the purpose and exercise of warranties and service policies on appliances. It was therefore suggested that instruction be allocated for: (1) the general content of a warranty and service policy; (2) the parts and service covered within a specific time period; (3) the obligations of the customer, manufacturer and retailer in the warranties and service policies; and (4) the responsibilities of the customer and the service technician.

At least 20 hours of instructional time is proposed for warranties and service policies in the one-year appliance service program.

Customer and Job Relations

An atmosphere exists, or can be created, which enhances sales, service or personal interactions. It was deemed important to include a period of instruction which could lead to some basic understandings of such atmospheres.

The Sales Climate

The appliance service technician can contribute to the overall atmosphere for selling by his (a) mental attitude, (b) physical appearance, (c) knowledge of product and service, (d) interest in the customer, (e) first impressions, and (f) sales approach and closing techniques. Such contributing elements are proposed for presentation and later exploration through case studies in this program.

The Service Climate

Again the service technician can play an important role in the creation of a promising existent and future satisfactory service atmosphere through (a) his mental attitude, (b) his physical appearance, (c) his knowledge of product to be serviced, (d) his professional approach to a service or customer problem, (e) his listening to the customer's story, (f) his etiquette in the customer's home, (g) realistic service charges, and (h) a proper acknowledgement of compliments or monetary rewards. It appeared paramount in a service technician's training to include the abovementioned areas for instruction and later analysis of case studies.

Getting Along with People

The appliance service technician must not only service and possibly sell his product but he must also "get along" with his customers, supervisors, peers and subordinates. Some of the contributing factors to this interaction were considered to be his (a) mental attitude, (b) enthusiasm, (c) temperament, (d) reliability, (e) giving and receiving constructive criticism, (f) faith and trust in his organization, co-workers and the customer, and (g) his physical appearance.

80 hours have been proposed for study in the customer and job relations area.

Merchandising and Warehousing

The development of a service organization can in a majorway depend upon what understanding and effort is evident in the display, demostration and warehousing of the product and its allied repair parts. A basic understanding of good merchandising was considered to be a need in the training of a service technician even though all of the merchandising and warehousing that he would do would be within his own service truck and tool box.

Only 20 hours of instruction and exploration are suggested for the one-year appliance service program.

Mathematics

Mathematics is the basis for the business operation and the understanding of electricity, physics and chemistry involved in an appliance service organization. It was therefore considered essential that a review of the common fractions, decimal fractions, powers and roots of numbers, and applications of same be a prime part of the appliance service program.

A further review of, or an introduction to, basic algebraic and trigonometric manipulations was considered important. The solution of simultaneous equations with one and two unknowns can be a valuable tool in the solution of varied electrical and other service problems. The solution of power factor, phase relationship, voltage drop, ohm's law, and similar problems should be a part of the problem-solving applications of mathematics as proposed in the program.

A minimum of 100 hours instruction is proposed for the one-year appliance service program.

Basic Electricity

Most appliances now have an electrical application in their operation. Some of these may have a total energy utilization of electricity for their operation while others may only have need for electrical controls, fans for cooling, or interior lighting. The basic understanding of fundamental electron electrical theory and its applications was considered to be of paramount importance to the appliance service technician.

A portion of the proposed program in Basic Electricity may be a mere review for some high school graduates but if such a review will firmly implant the knowledge of these fundamentals then the instructional effort will be worthwhile.

A minimum of 180 hours of instruction and experiments is suggested for the one-year program in appliance service. Such instruction and experimentation should include basic electron theory, symbols, ohm's law, magnetism and electric current, electromagnets, series-parallel circuits, inductance, capacitance, power factors, single and polyphase A-C power and instrumentation.

Basic Chemistry, Physics and Thermodynamics

Primary to the understanding of the work that an appliance is designed to do and how it accomplishes this job through electrical and gaseous energy applications, heating and cooling of gases, compression and expansion of gases, the chemical change and effects of chemicals on liquids and solids, etc., the basic laws and applications of Chemistry, Physics and Thermodynamics must be understood by the service technician. With such an understanding, the diagnosis of a problem, service and repair of the appliance will be an easier task for the service technician and could be an asset to him in customer and sales relations.

At least 160 hours of instruction and experimentation in Basic Chemistry, Physics and Thermodynamics is proposed for the one-year appliance service program.

Mechanisms and Controls

In the myriad of modern appliances available to the homeowner and business organization there is an even greater number of control devices to make these appliances operable and a true convenience. Such controls can generally be categorized as: (1) timers; (2) motor speed controls; (3) switches; (4) thermostats; (5) humidity controls; (6) overload protectors, (7) electromagnetic solenoid valves; (8) etc.

In the design of the one-year appliance service program it was deemed necessary to devote at least 80 hours to the study of the abovementioned control devices as they apply to the appliance conveniences of our day.

Appliance Servicing

Utilizing the basic principles and procedures of the aforementioned proposed instruction, the major part of the proposed appliance service training program, that of instruction in appliance servicing, should be the culmination of appropriate training for a prospective appliance serviceman. Proposed instruction in the installation, safety procedures, operating procedures, diagnoses of systems and problems, service and repair of major and small appliances is the final portion of the proposed one-year training program.

The purpose of the instruction and laboratory experiences in appliance servicing should be to develop a thorough understanding of the elements involved. 770 hours are suggested as a minimum time allocation for this segment of the program.

The aforementioned rationale for instruction and laboratory experiences in the proposed One-Year Appliance Service Technology Program results in the total program as outlined in Table I on page 12.

The program, as proposed, was designed as a 52 week project with 30 hours per week devoted to training within the classroom and laboratory. It is specifically oriented to the training of an appliance serviceman and the instruction and laboratory experiences should be in a practical, or applied, vein rather than a highly theoretical approach.

TABLE I

PROPOSED ONE-YEAR APPLIANCE SERVICE TECHNOLOGY PROGRAM

Courses	Hours
Communications Skills	50
Business Principles and Practices	100
Warranties, Service Policies, etc.	20
Customer and Job Relations	80
Merchandising and Warehousing	20
Mathematics	100
Basic Electricity	180
Basic Chemistry, Physics and Thermodynamics	160
Mechanisms and Controls	80
Appliance Servicing	770
TOTAL	1560

For Curriculum Guide for each course offering see Appendix A.

It must again be emphasized that the program is only a proposed project and much felxibility may be applied to it in order to adapt the suggested presentations to the specific training needs of a locale.

Proposed Time Schedule for Course Offerings

In order to afford continuity in the presentation of the basic cognate instruction, and possibly enhance the learning and applications experiences of the trainee, it is suggested that the cognate instruction begin first. This initial cognate instruction would include Communications Skills, Electricity, Mathematics, Basic Chemistry, Physics and Thermodynamics, and Mechanisms. After some of the elements of these areas are presented the appliance servicing, etc. could begin so that the basic fundamentals which are primary to the applied servicing, would be understood and then applied in the appliance service laboratory. The trainee would then advance in the cognate areas concurrently with his experiences in the appliance service laboratory. A proposed time schedule is indicated in Table II on page 14.

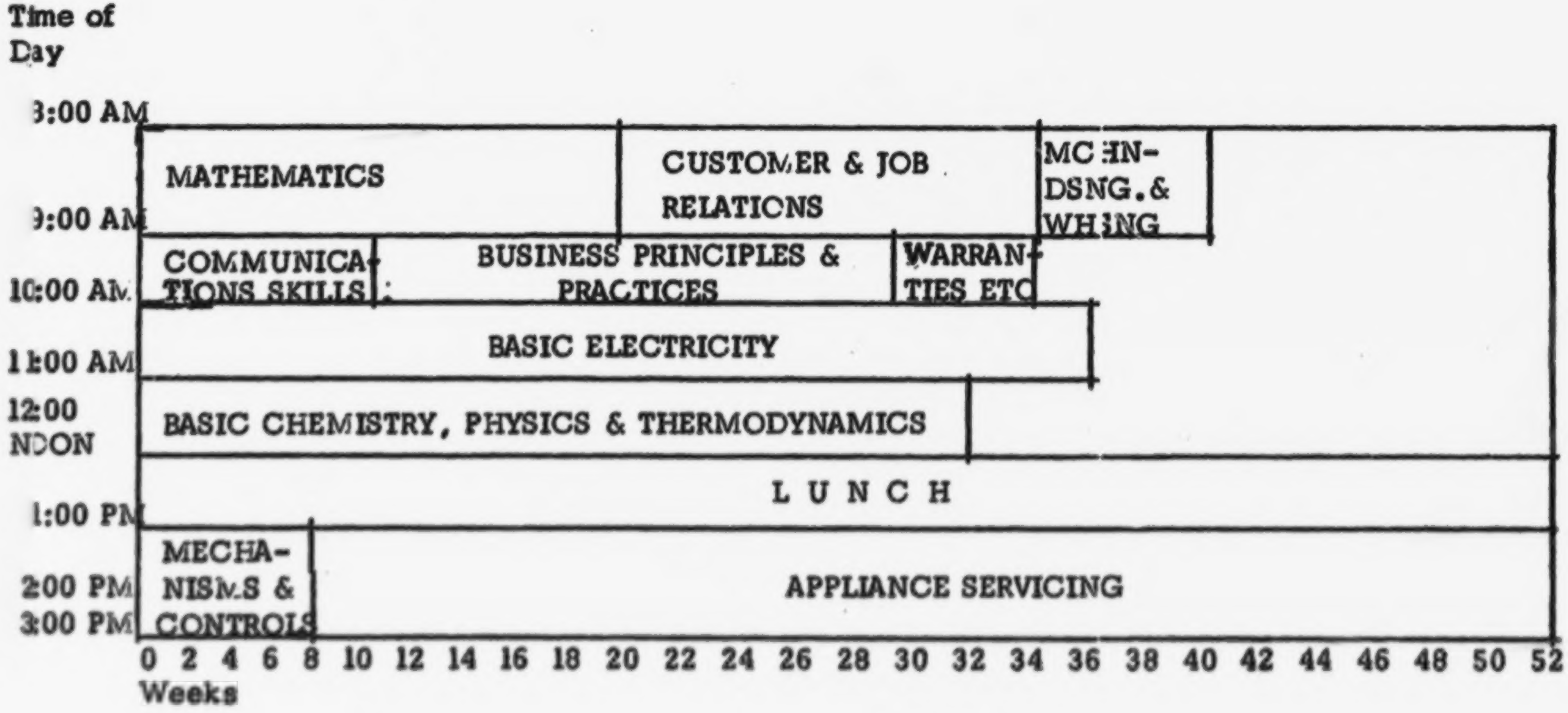
Facilities

The physical facilities needed to house the proposed one-year appliance service program would vary with the usable space that may be available within a specific institution for the classroom instruction.

Assuming a hypothetical situation in which one class of 20 are to begin instruction, and in which little instructional or appliance service laboratory space is available, the proposed needs would be:

TABLE II

PROPOSED TIME SCHEDULE FOR THE
ONE-YEAR APPLIANCE SERVICE TECHNOLOGY PROGRAM



1. Classroom. A general purpose classroom in which all instruction in Communications Skills, Mathematics, Business Principles and Practices, Customer and Job Relations, Merchandising and Warehousing, Basic Electricity, Mechanisms and Controls and all lectures and discussions in Basic Chemistry, Physics and Thermodynamics could be located in one portion of a supra-facility unit.

The instructional room segment should be sufficiently large to accomodate tables for the students allowing an approximate $2\frac{1}{2}$' x 3' individual work area. There should be approximately 16-24 lineal feet of chalkboard around two sides of the area. Sufficient storage cabinets, bookcases and shelving should be installed in order to house the reference materials, demonstration models and cut-aways, audio-visual equipment, instructional supplies, programmed instruction materials, basic analysis equipment, etc., and an instructor's demonstration table.

The suggested approximate size of the abovementioned instructional area is 800-1,000 square feet to allow sufficient room between work tables, storage, blackboards, and to allow for ready ingress and egress from any part of the area. It is suggested that this instructional area be segregated from the main appliance service laboratory by walls, screens, or partitions to insure a quiet, comfortable atmosphere in which to study.

In addition to the abovementioned instructional area, some provision must be made to provide laboratory space for the Basic Chemistry, Physics and

Thermodynamics. Such a facility would best be a laboratory now existent in an educational institution but if it does not exist then a separate combination laboratory should be designed. Specific exhaust hood systems, benches, plumbing, etc. are such an important part of such facilities that an integration of the cognate instruction into such a laboratory becomes dubious.

2. The Appliance Service Laboratory. A large open area is recommended for the appliance service laboratory. Freedom of movement of small and large appliances is mandatory if the objectives of the program are to be realized.

Individual work benches are recommended. On each of these benches there should be storage areas for small tools, test equipment, etc. as well as work space for diagnosis, disassembly, and repair of small appliances and sections, or subassemblies, of major appliances.

An area for appliance installation procedure instruction, testing and test-running of major appliances is needed. Also, an area for disassembly, repair and reassembly of major appliances must be provided. These areas must have sufficient 110 and 220 volt single and polyphase power outlets, hot and cold water connections, standpipe and floor drains, gaseous and air vent systems and connections, compressed air, natural or LP-gas connections, and with either installed pressure regulating devices on water, gas and air lines, or provisions made for attachments of such systems.

An area should be allocated for auxiliary shop tools and equipment; such as, pedestal grinders, lathe, arc welder, gas welder and cutting heads, power saws, anvils, large vises, spot welder, etc.

A large storage room to house appliances, spare parts, sheet metal, bar stock, welding supplies, etc. should be provided adjacent to the appliance service laboratory. This room should have accessability through both large and small doors to allow movement of material.

A suggested appliance service laboratory layout for 20 students include: (1) 20 individual workbenches along one wall of a large area (approximately 80 feet in length); (2) varied appliance hook-up, diagnosis, and repair areas across the room along the opposite wall; (3) a 20' x 40' storage room in one corner adjacent to the appliance hook-up area; (4) an open area of approximately 20 feet in width between the major appliance hook-up area and the individual workbenches for auxiliary shop equipment; (5) booths for arc and gas welders in the corner adjacent to the workbenches; and (6) the room for related instruction and library across the end of the facility opposite the storage room and welding booths. Faculty offices could be included in the area contiguous to the classroom.

The suggested floor space to house a program for a class of 20 students would therefore be: (1) 1000-1200 square feet for instructional area and faculty offices, and (2) 4,500-5,500 square feet for the appliance service laboratory, storeroom, auxiliary equipment, etc. A total of 5,500-6,700 square feet is suggested. The laboratory and storeroom area should be accessable through large doors to facilitate loading and unloading of small and large appliances from trucks, etc. and small doors for personnel ingress and egress. The area should be well ventilated and well lighted.

The major appliance hook-up, diagnosis, repair and test-run area should include a minimum of 6 stations for washers and dryers, 2 for heating systems, 4 for water heaters,4 for air conditioning systems, 4 for ranges, 4 for refrigerators and freezers, and 4 for dishwashers and waste disposers. The small appliances such as, percolators, toasters, irons, grills, etc. can be diagnosed, serviced and repaired on the individual student workbenches provided.

Much flexibility can be designed into a laboratory facility but it is hoped that the abovementioned proposal can serve as a rough guideline. Varied appliance categories, such as, airconditioning heating, washer-dryers, could be sectionalized and housed in individual laboratories.

Equipment

The proposed equipment for the establishment of the one- or two-year Appliance Service Technology Program is included in Appendix B. All of the listed equipment may not be deemed necessary to everyone and other important itmes were probably omitted.

CHAPTER III

THE PROPOSED TWO-YEAR APPLIANCE SERVICE TECHNOLOGY PROGRAM

The rationale in the design of a two-year Appliance Service Technology Program was similar to that for the proposed one-year program in that it was considered necessary for the trained technician to be literate, familiar with business practices and procedures, possess skills in mathematics and the basic sciences and be capable of appliance problem diagnosis, installation and repair. The basic differences in the two programs are in the purpose and level of training and probable employment of the trained personnel.

The one-year program is proposed for the training of an appliance serviceman and possible owner and/or manager of a retail outlet. The two-year program is designed to train personnel who could serve in these capacities but who could also be employed as a technician working with engineers in the design, manufacture, or testing of varied appliances. This latter program can lead to an associate degree from a community-junior college or other two-year associate degree granting institution or technical institute.

The two-year technology program was not designed to be transferrable in totum to a 4-year college or university and leading to a baccalaureate degree. Some of the courses (Speech, English, Political Science and Business courses) may be transferrable as courses.

The following seven subject areas were considered to be essential in the two-year training program of an Appliance Service Technician.

Communications Skills

Assuming that the two-year Appliance Service Technology Program is to possibly culminate in an associate degree it is recommended that the subjects in Communications Skills be at the college level. Therefore, a two-semester sequence of College Freshman English has been designed into the program. A review of English fundamentals is suggested along with emphasis upon vocabulary building, summarizing, and theme writing in the first semester. The second semester should be a continuation of the preceding work as well as readings of short stories, poetry and drama. Usage of the library and the completion of a research paper should be incorporated.

The development of abilities in effective speaking in extemporaneous, informal and formal situations should be a part of the Communications Skills instruction. A college-level course in the fundamentals of Speech has been included in the program for this purpose.

The objectives of these courses are to hopefully create an awareness of quality in writing and the appreciation for literary works, enable the technician to assimilate information in a coherent manner and to express himself verbally, and in writing, in a meaningful and effective way.

Business

Since the two-year appliance service technician may be a businessman, a supervisor in a distributive or service organization, or an engineering technician the: (1) principles of salesmanship, (2) business law, (3) principles of management, and (4) principles of accounting were considered a suggested requirement in the training program. All of these areas of instruction have been included in the program.

The proposed courses should include (a) the principles of salesforce organization and operation and selling techniques; (b) the principles of design of interior and exterior merchandise display; (c) the principles of management and organization of the modern organization; and (d) the study of accounting principles and their applications.

Mathematics

In the design of the two-year appliance service program Mathematics was again considered paramount for the understanding of the business operation, the basic sciences and their applications. A two-semester sequence of Mathematics is recommended which could go up to calculus or possibly include an introduction of calculus. It is recommended that a review of the fundamentals of algebra be stressed along with the study of algebraic functions, graphs, linear and quadratic equations, simultaneous quadratic equations with several unknowns, exponential and logarithmic functions, trigonometric and inverse functions, analytic geometry and its applications, and possibly an introduction to the calculus be stressed.

The suggested sequence of courses in the two-year program should promote an adequate background in Mathematics prior to enrollment in

Physics and Electricity-Electronics.

Electricity-Electronics

To assure the opportunity for the student to receive a sound basis in electricity and basic electronics a two-semester sequence is suggested in the two-year appliance program. The first course should include (a) the basic physics of the electron, (b) electrical units, (c) magnetism, (d) ohm's law, (e) resistance and varied resistance combinations and its measurement, (f) wire measurements, (g) D.C. power and its applications, (h) D.C. circuitry, (i) A.C. theory, (j) power characteristics, (k) inductance and capacitance, (l) meters and their connections, (m) the principles of motors, generators and dynamos, (n) varied A.C. characteristics and circuits, (o) etc. The second semester sequence should introduce (a) the theory and operation of vacuum tubes, transistors, diodes, etc., (b) power supplies, (c) electronic control devices and circuitry, (d) test procedures and analysis of electronic control units, (e) etc. Both courses should allow laboratory experiences.

Chemistry and Physics

The structure of the atom, weight relationships, chemical bonding, the heat capacity of gases, quantum theory, radiation, solutions, solubility, electrolytes, rates of reaction, oxidation and reduction, etc., and the generalized study of changes in properties of matter should be of much value to the appliance service technician. A course in chemistry to explore some of these phenomena and to study the applications of same to the appliances that are to be built, tested and serviced is suggested for the program. Variations with more possible practical applications and tests could be devised and integrated into the program.

A basic practical course in Physics is recommended. Since two semesters of electricity-electronics are included in the program it was decided that the one semester of Physics could be devoted primarily to the study of energy, force, simple machines, mechanical advantage, gases, solids and fluids in mechanics; to wave mechanics, sound waves and the velocity of sound in the physics of sound; and to temperature, expansion, kinetic theory, calorimetry, mechanical equivalence, heat transfer, and change of state in the physics of heat.

Appliance Servicing

The time allocation for courses in appliance servicing was diminished over that of the one-year program. Actual clock-hours for each proposed course is dependant upon the evaluation and equation of time devoted to laboratory experiences to the credit hour designation. It was proposed that in the 4-hour course (Appliance Servicing I) there should be a minimum of 1 hour per week lecture and 6 hours of laboratory time and in the 5-hour courses (Appliance Servicing II and III) there should be 2 hours per week of lecture and 6 hours of laboratory time . Therefore, the equation of time would be 1:1 for lecture periods and 2:1 for laboratory experiences per credit hour allocated. With this designation there could be 357 hours of (85 hours lecture and 272 hours of laboratory) devoted to Appliance Servicing in the total proposed program.

It is suggested that the courses in Appliance Servicing be delineated as: (a) Appliance Servicing I -- the instruction and experience in the diagnosis, service and repair of small appliances; such as, percolators, toasters, irons, grills, mixers, fans, vacuum cleaners and waste disposers, etc.; (b) Appliance Servicing II -- the instruction and experience in the trouble diagnosis, installation, service and repair of washers, dryers, water heaters, ironers, dishwashers, etc.; and (c) Appliance Servicing III -- the installation, problem diagnosis, service and repair of air conditioning units and systems, heating systems, humidifiers, dehumidifiers, etc.

Other Courses

If the trained graduate of the two-year program is to work as a technician it was considered important that he have an understanding of, and a basic skill, in drawing which could be an asset for him when working with engineers or in making heating-air conditioning layouts, etc. Also, all technicians have a need for schematic and blue-print interpretation. As a result, a 2-hour drawing course was included in the program.

A course in Political Science was incorporated into the two-year program due to the requirement for such a course in many states. The course should assist in the development of a better citizen-technician through a better understanding of our governmental structure and operations.

The aforementioned design rationale for the design of the two-year Appliance Service Technology Program resulted in the proposed program as indicated in Table III on page 26.

As previously mentioned, the two-year program can culminate in an associate degree, courses of which could transfer to a four-year college or university and be applicable toward a baccalaureate degree.

Facilities

If the two-year program were offered within an institution, and an associate degree is granted upon satisfactory completion of the program, it should be integrated into the activities and schedule of the entire organization. Therefore, classrooms and laboratories existent for similar course offerings should be available and utilized for all instruction except perhaps for the appliance service laboratory. The same space requirements of 4,500 to 5,500 square feet of storage area, appliance service, individual work stations and open common shop area, as suggested for the one-year training program, would also apply for the appliance service laboratory in the two-year program with the same number of students (20)involved. Reference should be made to Chapter II for the recommendation.

TABLE III

PROPOSED TWO-YEAR APPLIANCE SERVICE TECHNOLOGY PROGRAM

First Year

Semester I	Credit Hours	Semester II	Credit Hours
English Composition	3	English Composition	3
Technical Mathematics	3	Advanced Technical Mathematics	3
Salesmanship	2	Electricity-Electronics	4
Fundamentals of Electricity	5	Drawing	2
Mechanisms and Controls	2	Appliance Servicing I	4
	15		16

Second Year

Semester I	Credit Hours	Semester II	Credit Hours
Accounting	3	Principles of Management	3
Technical Physics	3	Fundamentals of Speech	3
Political Science	3	Business Law	3
Appliance Servicing II	5	Technical Chemistry	3
Psychology	2	Appliance Servicing III	5
	16		17

For suggested curricula guide for each course offering see Appendix A.

Equipment

The proposed list of equipment necessary for the establishment of a one- or two-year program is included in Appendix B.

CHAPTER IV

SUGGESTED CRITERIA FOR THE ESTABLISHMENT OF A PROGRAM IN APPLIANCE SERVICE TECHNOLOGY

Paramount and precedent to the adoption and initiation of an Appliance Service Technology Program it is recommended that some of the following steps and procedures be given consideration.

1. Establishment of an Advisory Committee. To inject the importance of the appliance industry's gross knowledge and experience into the formulation and possible adoption of an appliance service program in any community it is recommended that an advisory committee, composed of appliance manufacturer, distributor and retailer representatives and representatives from educational institutions, be formulated for the initial overall exploration and study of a possible program. The need for such a program, and the type of training to help satisfy the need, must be explored. The members of an adivisory committee can also be of inestimable value to the initiation, support and later general success of the program.

A relationship with the appliance industry and a coordination with their training programs will avoid much duplication of effort since the projects should complement one another to make the ultimate training of appliance service technicians a reality and a success.

2. A Feasability Study. A study to determine (a) the existent and

projected need for trained appliance service technicians; (b) the type of program needed; (c) a possible source of students for the program; and (d) the determination of possible local assistance for the initiation and operation of the program is recommended prior to consideration of the adoption of a specific program. The abovementioned advisory committee can be of invaluable assistance in this project.

Samples of questionnaires used in a Feasabiltiy Study are included in Appendix C. A partial adoption, modification, or total rejection, of these sample questionnaires for a possible study within a specific locale is invited.

3. Type and Duration of a Program. The type and duration of an appliance service program to be considered by a specific group should be formulated to explore the possible need satisfaction by the program. The enclosed suggested one- and two-year programsare intended only as guidelines for consideration. A specific program of type and duration should be adopted since facilities, faculty, financial and other needs affect the further planning for program initiation.

4. Facilities and Equipment. After the type and duration of the program has been determined and the maximum number of students per class and the number of classes to be operated concurrently has been estimated, the facility needs can be estimated. If facilities must be built then the detailed planning can be initiated. The necessary equipment to begin the program can now be estimated.

5. Finance. Financial support for an adopted program can possibly be derived from several sources. These sources include: (a) local; (b) manufacturers and/or foundations; (c) state; and (d) Federal.

Local support for an appliance service program can be derived from taxes in a public institution and from possible grants of monies, used and new appliances, or shop equipment from local appliance wholesalers and retailers. A possible loan arrangement, with local wholesalers, of new appliances for demonstration and familiarity should be explored. The maintenance of a supply of the latest models for such purposes is an important asset to the training of a technician.

Other possible local support is in the form of supplying the latest technical data and maintenance manuals on the many brands and types of appliances.

Locally supported scholarships for worthy and capable students interested in Appliance Service Technology can add much impetus to a program.

Manufacturers and foundations could monetarily assist the establishment of a specific program. If such efforts are not rewarded, the manufacturers can provide assistance by means of (a) supplying the latest in technical and service information relative to their product; (b) supplying occasional demonstration equipment and/or materials; (c) lectures and demonstrations by field and factory personnel; (d) correlation of their training programs to avoid duplication of effort; and (e) in-service training for local instructional personnel.

State support is normally in matching funds or reimbursement for equipment, facilities and instructors salaries. Most of the Federal monies for support of such programs are now allocated through States, under the respective State Master Plans, so must be applied for through the State. Possible financial assistance is included under (a) The Vocational Education Act of 1963; (b) The George Barden Act; (c) The Smith-Hughes Act; (d) Manpower Development Training Act; and (c) etc. It should be suggested that the State Department of Education, or Instruction, be contacted in each respective state for possible state and/or federal assistance for an appliance service program.

6. Operation of the Program. Upon the determination of the program to be offered, the facility needs and construction, instructional costs, and staff, the program will be ready for operation.

Instructional staff can be obtained from several sources. The instructional needs in the cognate areas (Business, the Sciences, Mathematics, Communications, etc.) can be satisfied from existent institutional personnel or on a part-time basis by qualified persons in the community.

Instructors for the appliance servicing portion of the program should be persons with experience in the field of instruction. The support of local wholesalers and retailers may possibly release a qualified person for this service or it could be done with several part-time qualified instructors. The policies of the institution must be considered in the arrangement.

After following the aforementioned suggested criteria for the establishment of an appliance service program, the project should be operable. A suggested checklist for the establishment of an appliance service program is outlined in Table IV

TABLE IV

A SUGGESTED CHECKLIST FOR THE ESTABLISHMENT OF A PROGRAM IN APPLIANCE SERVICE TECHNOLOGY

Suggested Criterion	Check
1. Establishment of an Advisory Committee	
2. A Feasability Study	
3. Determination of Type and Duration of Program	
4. Determination of Facility and Equipment Needs	
5. Finance	
6. Operation of the Program	

CHAPTER V

SUMMARY AND RECOMMENDATIONS

The need for post-high school appliance service training program has been indicated but no general agreement has been attained regarding the level and duration of such a program. Proposed programs were presented to manufacturers, wholesalers and retailers for evaluation. The suggestions resulting from these presentations pinpointed a probable need for a one-year and a two-year program with different levels of training as an objective. The two programs herein proposed were designed with this objective as a basic premise.

The purpose of this report was to:

1. Present a one-year and a two-year proposed Appliance Service Technology Program.
2. Develop and present basic course outlines for both programs.
3. Present recommendations for facility and equipment requirements to establish an appliance service training program.
4. Present possible guidelines for the overall establishment of an appliance service training program.

After considerable correspondence with appliance manufacturers and associations, visitations to facilities presently operating appliance service training programs, and guidance from the Advisory Committee;the enclosed programs evolved as suggested offerings to help satisfy the training needs of appliance service technicians. The basic general course outlines for these programs were developed and recommendations for required facilities and equipment to establish either program were established.

It is hoped that the proposed programs, course outlines, recommended facility space and equipment, and the suggested procedures for the establishment of an appliance service technology program may serve as a possible guideline in the much needed appliance service training efforts of our nation.

Recommendations

It is recommended that:

1. A closer liaison be established between the appliance industry and educational institutions to attempt satisfaction of manpower training needs in appliance service in our nation.
2. Many post-high school educational institutions attempt to determine the feasability of establishing an appliance service technology program as a service to the appliance industry and our nation.
3. In the establishment of appliance service programs:
    a. A program of type and duration be adopted to meet the needs of the locale to be served.
    b. Duplication of the manufacturer's training efforts be avoided.
    c. Facility and equipment needs be adequately satisfied to

insure a quality program.

d. A rapport be established with manufacturers, wholesalers, and retailers of appliances to provide new and used appliances on a loan or grant basis to prevent obsolescence in training aids.

e. A sound financial base be established for the program with possible funds from local sources, manufacturers, state sources and federal Acts.

f. Qualified faculty be recruited from colleges and universities as well as from the appliance industry.

g. Solicitation be made of appliance manufacturers for source and reference materials needed in instruction.

h. A promotional campaign be initiated to ensure more appliance service training and qualified interested students.

i. Cooperative efforts be maintained between the educational institution and the appliance industry.

4. Further research and planning be allocated to appliance service training.

APPENDIX A

CURRICULUM GUIDE

FOR THE

PROPOSED ONE-YEAR
APPLIANCE SERVICE
TECHNOLOGY PROGRAM

COMMUNICATION SKILLS

The purpose of this course is to provide the principles of communication skills of English and speech to an individual to help make him a more effective communicator as a businessman or employee in Appliance Service.

Text: Gowen. English Review Manual. New York: McGraw-Hill Book Company. 1965.

Thompson. Fundamentals of Communication. New York: McGraw-Hill Book Company. 1957.

Baird and Knower. Essentials of General Speech. New York: McGraw-Hill Book Company. 1960.

Sandford and Yeager. Effective Business Speech. New York: McGraw-Hill Book Company. 1960.

Suggested Presentation:

Classwork	Related Information
English	
1. Review of the fundamentals of English	1. Grammar 2. Spelling 3. Punctuation 4. Capitalization 5. Etc.
2. Vocabulary building	1. Exercises in word usage, sentence structure, etc.
3. Report and letter writing	1. Reports on laboratory experiments and appliance servicing 2. Personal letter writing, business letter writing, applications, etc.
Speech	
1. Introduction to informal and formal speaking	1. Basic principles of effective speaking

2. Application of basic principles and practices of effective speaking	1. Speaking in informal and simulated formal situations

WARRANTIES, SERVICE POLICIES, ETC.

The purpose of this course is to provide a basic understanding of warranty and service policies on home appliances as may be encountered by an appliance serviceman, a businessman, or an employee.

Text: Sample Warranties and Service Policies from appliance manufacturers.

Suggested Presentation

Classwork	Related Information
Warranties	
1. Warranties on appliances	1. General content 2. Obligation of manufacturer 3. Obligation of retailer 4. Service responsibilities 5. Customer responsibilities
2. Escalation on parts and service	1. Parts and service covered within a specific time period 2. Customer and manufacturer responsibility
Service Policies	
1. Service policies on appliances	1. General content 2. How are they sold 3. Service responsibilities for manufacturer and retailer 4. Customer responsibilities

CUSTOMER AND JOB RELATIONS

The purpose of this course is to provide a basic understanding of the human relationships, personality adjustments, and attitudes of individuals in customer service and sales environments and with fellow workers.

Text: Laird and Laird. Practical Sales Psychology. New York: McGraw-Hill Book Company.
Bender. How to Sell Well. New York: McGraw-Hill Book Company.
Davis. Human Relations at Work. New York: McGraw-Hill Book Company.
Hegarity. Making Your Sales Presentation Sell More. New York: McGraw-Hill Book Company.

Suggested Presentation

Classwork	Related Information
Customer Relations	
1. The sales climate	1. Mental attitude 2. Physical appearance 3. First impressions 4. Knowledge of service 5. Knowledge of product 6. Interest in customer 7. Closing 8. Case studies
2. The service climate	1. Mental attitude 2. Physical appearance 3. Knowledge of product 4. Customer's story 5. Professional approach 6. Home etiquette 7. Service charges 8. A "thank you" 9. Case studies

Job Relations

1. Getting along with people
    1. Mental attitude
    2. Enthusiasm
    3. Temper
    4. Reliability
    5. Giving and receiving constructive criticism
    6. Faith and trust in company co-workers
    7. Physical appearance
    8. Case studies

MERCHANDISING AND WAREHOUSING

The purpose of this course is to provide a basic understanding of the principles of good merchandising for increased sales and service and of warehousing appliances and parts.

Text: Stanton. Fundamentals of Marketing. New York: McGraw-Hill Book Company.

Suggested Presentation

Classwork	Related Information
Merchandising	
1. Prices, discounts, profits, etc.	1. Purchase prices, mark-up, profits 2. Service costs 3. Interest on monies borrowed for operations or inventories
2. Merchandise design and display	1. Principles of display, design and installation 2. Factors related to consumer selection
3. Advertising and sales promotion	1. Principles of advertising in promoting merchandise
Warehousing	
1. Utilization of space	1. Space for appliances 2. Parts storage
2. Inventory	1. Card and file indices 2. Revolving inventory 3. Best utilization of money and space

BUSINESS PRINCIPLES AND PRACTICES

The purpose of this course is to provide the principles and practices of business in: (1) economics, (2) accounting, (3) marketing, and (4) salesmanship, which should help make an individual a more effective businessman or employee in the appliance industry.

Text: Bates and Parkinson. Business Economics. New York: McGraw-Hill Book Company.
Lynn. Basic Economics. New York: McGraw-Hill Book Company.

Suggested Presentation

Classwork	Related Information
Economics	
1. Principles of Economics	1. Economic organization and growth 2. Supply and demand 3. The full-employment theory of interest and profits 4. Money and the nature of credit 5. The problem of inflation and control 6. Business--cycle, theory, and control 7. National income, production, and employment 8. The Federal Reserve System and money supply 9. Labor unions and collective bargaining 10. Tax structure 11. The role of government and business
Accounting	
1. Principles of Accounting	1. Recording, analyzing, and interpreting financial statements 2. Accounting procedures 3. Problems

Marketing

1. Basic principles and practices in marketing	1. Commodity approach to buying and selling 2. Institutions in the marketing system 3. Buying, selling, transporting, storing, grading, financing, etc. 4. Customer satisfaction and profit

Salesmanship

1. Fundamentals of Salesmanship	1. Needs of salesmanship 2. Tools of salesmanship 3. Creative selling 4. The sales atmosphere 5. Traits of a salesman 6. Experience

MATHEMATICS

The purpose of this course is to provide a review of basic mathematics and to introduce and apply algebraic functions and trigonometry.

Text: Schumacker. Vocational Mathematics, Vol. I. Chicago: The Goodheart-Willcox Company, Inc.
Schumacker. Vocational Mathematics, Vol. II. Chicago: The Goodheart-Willcox Company, Inc.
Singer. Basic Mathematics. New York: McGraw-Hill Book Company.

Suggested Presentation

Classwork	Related Information
1. Review of basic mathematics	1. Common fractions 2. Decimal fractions 3. Powers and roots 4. Applications
2. Algebraic and trigonometric functions	1. One and two unknowns 2. Simultaneous equations 3. Trigonometric relationships 4. Slide rule 5. Applications

BASIC ELECTRICITY

The purpose of this course is to introduce the basic elements of electrical theory and applications.

Text: Tepper. Basic Radio, Vol. 1,2 & 3. New York: John F. Rider Publisher, Inc.
Timbie, Elements of Electricity. New York: John Wiley & Sons.
Perry and Schafebook. Fundamental Jobs in Electricity. New York: McGraw-Hill Book Company.
National Bureau of Fire Underwriters, National Electrical Code. New York: McGraw-Hill Book Company.

Suggested Presentation

Classwork	Related Information
1. General introduction	1. Electron theory 2. Sources and production of electricity 3. Electrical symbols 4. Basic circuitry
2. Ohm's Law	1. Relationship between voltage, amperage, and resistance 2. Applications
3. Magnetism and electromagnetism	1. Magnetism and electric current 2. Electromagnets
4. Principles of D-C current	1. Ohm's Law 2. Series circuits 3. Parallel circuits 4. Multiple circuits 5. Power 6. Wire sizes 7. Voltage drop and line losses 8. I-R drop and line losses 9. Electromagnetic 10. Magnetic circuit

11. Electromagnetic induction
12. Capacitance
13. Instruments
14. Laboratory applications

5. Principles of A-C current

1. Fundamentals of A-C current
2. Inductance and inductive reactance
3. Capacitance and capacitive reactance
4. Series circuits
    a. Resistance and inductance
    b. Resistance and capacitance
    c. Resistance, inductance, and capacitance
5. Parallel circuits
    a. Inductance
    b. Inductance and capacitance
6. A-C power and power factor
7. A-C single phase power
8. A-C polyphase power
9. Wye and Delta systems
10. Single-phase, three-wire installations
11. Three-phase, three-wire installations
12. Electromagnetism
13. Laboratory applications

6. Circuit drawings

1. D-C circuits
2. A-C circuits
    a. Single phase
    b. Three phase

BASIC CHEMISTRY, PHYSICS, AND THERMODYNAMICS

The purpose of this course is to provide the basic information needed in the principles of electricity, refrigeration, and appliance operation efforts.

Text: Watt. Basic Concepts in Chemistry. New York: McGraw-Hill Book Company.
Harris. Applied Physics. Ann Arbor: University of Michigan.
Buech. Principles of Physics. New York: McGraw-Hill Book Company.

Suggested Presentation

Classwork	Related Information
Chemistry	
1. Basic chemistry	1. Valence theory
	2. Basic reactions
	3. Effects of detergents, bleaches, etc.
	4. Water chemistry
	5. Corrosion
	6. Combustion
	7. Laboratory applications
Physics	
1. Basic physics	1. Work
	2. Mechanical advantage
	3. Magnetism
	4. Electricity and electromagnetism
	5. Specific heat
	6. Latent heat
	7. Heat of combustion
	8. Heat of compression
	9. Heat of vaporization
	10. Laboratory applications

Thermodynamics

1. Basic thermodynamics	1. Effects of compression of gases in refrigeration 2. Effects of vaporization in refrigeration 3. Expansion of liquids and gases 4. Effect of temperature 5. Laboratory applications

MECHANISMS AND CONTROLS

It is the purpose of this course to introduce the various mechanisms and controls and explain their operations as found in varied appliances.

Text: Zimmerman. Elementary Kinematics of Mechanisms. New York: Wiley & Sons.
Service Manuals from Manufacturers.

Suggested Presentation

Classwork	Related Information
Mechanisms	
1. Theory and structure of appliance mechanisms	1. Motors 2. Transmissions 3. Timers 4. Solenoids 5. Heating elements and burners 6. Ignition (gas) 7. Compressors 8. Fans and blowers 9. Pumps 10. Laboratory applications
Controls	
1. Theory and operation of appliance controls	1. Timers 2. Motor speed 3. Switches 4. Thermostats 5. Humidity 6. Overload protection 7. Temperature 8. Water levels 9. Laboratory applications

APPLIANCE SERVICING

The purpose of this course is to develop a thorough understanding of the installation, operation, safety procedures, diagnosing problems, and servicing electrical and gas home appliances.

Text: Brockwell. Small Appliance Servicing. New York: McGraw-Hill Book Company.
Brockwell. Major Appliance Servicing. New York: McGraw-Hill Book Company.
Crouse. Electrical Appliance Servicing. New York: McGraw-Hill Book Company.
Manly. Refrigeration Service Manual. Chicago: Electrical Appliance Service News.
Derman, Makstein, Seaman, Home Air Conditioning Installation and Repair. Chicago: Electrical Appliance Service News.
Auslander, Domestic Oil Burners and Oil Heat. Chicago: Electrical Appliance Service News.
Service Manuals from Manufacturers.

Suggested Presentation

Classwork	Related Information
Washers	
1. Installation procedures	1. Location relative to power supply, water supply, and drainage 2. Leveling 3. Grounding 4. Voltage, water pressure and temperature tests 5. Drain capacity and operation
2. Safety procedures	1. Proper grounding of the appliance according to local codes 2. Proper water connections 3. Proper power requirements 4. Disconnect power source to service appliance 5. Etc.

3. Operating procedures	1. Test run and time the operation 2. Instruction of customer on use of the washer--proper loading, soap, clothes to be washed, bleaches, and general operation of the timer and the appliance
4. Diagnosing and servicing the electrical system	1. Interpretation of electrical diagrams 2. Operational characteristics and sequences 3. Functions of each electrically-operated component 4. Remove, test, repair, and replace the electrical components 5. Procedures for locating electrical troubles 6. Laboratory problem diagnosis and remedy
5. Diagnosing and servicing the water systems	1. Interpretation and tracing of water flow diagrams 2. Function of each water system component 3. Remove, test, repair, and replace components 4. Procedures for diagnosing and locating problems in the water system 5. Laboratory applications of water system problem diagnosis and remedy
6. Diagnosing and servicing the mechanical system	1. Operational characteristics and sequences 2. Functions of each component 3. Dismantle, inspect, repair, and replace bearings, rollers, etc. of the entire mechanical system 4. Test run 5. Procedures for locating mechanical problems

	6. Laboratory applications

Dryers

1. Installation procedures	1. Location relative to power supply, gas, water, and vent 2. Leveling 3. Grounding 4. Test voltage and ground
2. Safety procedures	1. Proper electrical supply and ground, according to local codes 2. Grounding according to local codes 3. Test safety components on the appliance 4. Power and gas to be disconnected before service work is attempted
3. Operating procedures	1. Test run and time the operation 2. Instruction of customer on usage of the appliance--proper loading, type of clothes, degree of drying, and general operation and care of the appliance
4. Diagnosing and servicing the electrical system	1. Interpretation of electrical diagrams 2. Operational characteristics and sequences 3. Functions of each electrically-operated component 4. Remove, test, repair, and replace the electrical components 5. Procedures for locating electrical problems 6. Laboratory applications for locating and diagnosing electrical problems

5. Diagnosing and servicing the gas system on a gas dryer	1. Check electrical system and components applicable to the operation of the gas system as above 2. Interpretation of the gas flow diagrams 3. Functions of each gas system component 4. Operational characteristics and sequences 5. Gas burners, combustion, and adjustment of the air-fuel mixtures 6. Ignition--electrical or standing pilot 7. Orifice requirements for natural, manufactured, and LP gases. Conversion possibilities from one to the others 8. Proper combustion venting of the appliance 9. Remove, test, repair, and replace the gas system components 10. Testing for, locating, and remedying gas leak problems in the system 11. Check and set incoming gas line pressures 12. Procedures for locating and diagnosing gas system problems 13. Laboratory applications for gas system analysis and service
6. Diagnosing and servicing the air and water systems	1. Interpretation of air and water flow diagrams 2. Function of each component 3. Remove, test, repair and replace components 4. Procedures for diagnosing and locating problems in the air and water systems

	5. Laboratory applications of air and water systems problem diagnosis and remedies
7. Diagnosing and servicing the mechanical system	1. Operational characteristics and sequences 2. Function of each component and part 3. Disassemble, inspect, repair, and replace all parts and components of the mechanical system 4. Test run 5. Procedures for locating mechanical problems 6. Laboratory applications

Ranges

1. Installation procedures	1. Locate power or gas supply 2. Test voltage on power supply and gas pressure on gas supply 3. Install electrical card and/or gas supply 4. Level 5. Ground 6. Test for voltage at range and for leaks, etc. of gas
2. Safety procedures	1. Ground according to local codes 2. Check fusing or circuit breaker size 3. Disconnect power supply and/or gas for servicing
3. Operating procedures	1. Test surface units and oven element in electric ranges 2. Light the pilots and check operation of gas burners. Adjust fuel-air mixtures 3. Check and adjust automatic controls on oven and burners

	4. Check operation of timers 5. Instruct user on proper usage of the range and proper utensils and methods
4. Diagnosing and servicing the range	1. Interpretation of electrical and gas systems 2. Operational characteristics and sequences of components 3. Functions of each component 4. Remove, test, repair, and replace all components 5. Procedures for locating problems 6. Laboratory applications in diagnosis and remedy of problems

Water Heaters

1. Installation procedures	1. Locate power and/or gas supply 2. Placement as near to kitchen and bathroom as possible 3. Install power, gas, and ground connections according to local codes 4. Install plumbing connections according to code 5. Level 6. Proper venting of the gas appliance
2. Safety procedures	1. Check wire sizes, fuses, circuit breakers, gas supply, vent, etc. 2. Check limit temperature controls 3. Check operation of temperature-pressure relief valve 4. Check operation of 100% safety cut-off units of gas appliance 5. Check vent efficiency
3. Operation procedures	1. Check and test heating elements, burners, and pilot lights

	2. Test and set thermostatic-temperature controls 3. Instruct user on operation of the appliance
4. Diagnosing and servicing the water heater system	1. Interpretation of electrical, gas, and water diagrams and systems 2. Operational characteristics and sequences of controls and components 3. Remove, test, repair, and replace controls and components 4. Test and replace tank 5. Test for water and gas leaks 6. Procedures for locating troubles 7. Laboratory applications

Refrigerators-Freezers

1. Installation procedures	1. Locating power and/or gas supply 2. Locating heating registers, radiators, etc. 3. Placement and leveling of appliance 4. Test power and/or gas supply 5. Installation, connection and test of gas connections when applicable. Set pilot and burner fuel-air mixture
2. Safety precautions	1. Check fuses and circuit breakers on electrical power supply and gas pressures and leakage in gas system 2. Proper grounding where required 3. Power and/or gas disconnection or shut-off prior to service
3. Operation procedures	1. Checking and testing of refrigeration system 2. Test thermostat 3. Test run the appliance

	4. Instruct user on operation and care of appliance
4. Diagnosing and servicing the electrical and/or gas system	1. Interpretation of electrical and/or gas system diagrams 2. Operational characteristics and sequences of controls and components 3. Remove, test, repair, and replace controls and components 4. Test for gas leaks, etc. 5. Procedures for locating troubles 6. Laboratory applications
5. Diagnosing and servicing the refrigeration system	1. Operational analysis of the refrigeration system 2. Remove, test, repair, and replace compressors, hydrators, expansion valves, condensors, evaporators, etc., and recharge the system 3. Testing and running the system 4. Procedures for locating troubles 5. Laboratory applications of diagnosis and remedy of troubles

Room Air Conditioners

1. Determination of capacity needs for a room, etc.	1. Heat conductivity through windows, doors, walls, etc. 2. Insulation 3. Area or volume to be cooled 4. Exposure to sun of area to be cooled 5. Occupants 6. Sizing of unit
2. Installation procedures	1. Locating unit in room relative to sun exposure on unit 2. Locating unit relative to circulation of outside air for condensor cooling 3. Locating unit relative to cool air circulation within area to be cooled

	4. Location of power supply 5. Location in properly-sized window 6. Installation of unit 7. Test of voltage in power source 8. Test run 9. Instruction of user on operation
3. Safety precautions	1. Fuses, circuit breakers, and wire sizes 2. Grounding per code 3. Power disconnected before and during service work
4. Diagnosing and servicing the electrical system	1. Interpretation of electrical system diagrams 2. Operational characteristics and sequences of controls and components 3. Remove, test, repair, and replace controls, relays, etc. 4. Procedures for locating troubles 5. Laboratory applications
5. Diagnosing and servicing the refrigeration and mechanical systems	1. Interpretation of the refrigeration cycle diagram 2. Operational analysis of the refrigeration cycle 3. Remove, test, repair, and replace compressor, blower, condensors, evaporators, expansion valves, etc. and recharging the system 4. Leak detection and operation 5. Procedures for locating troubles 6. Laboratory applications

Heating

1. Determination of capacity needs for a home	1. Heat conductivity through buildings and building materials 2. Area or volume to be heated 3. Sizing of heating unit

4. Sizing and placement of burner unit, blower, and ducting. Location of warm outlets and cold air returns

2. Installation of system
    1. Power and fuel requirements and installation to the unit
    2. Location of heating unit
    3. Installation of heating unit
    4. Thermostat location
    5. Test run
    6. Instruction of user
3. Safety precautions
    1. Fuses, wire sizes in power source
    2. Fuel supply location, volume, and shut-off
    3. Operation of 100% safety shut-off equipment
    4. Fire extinguishers
    5. Fire regulations on location of unit and service
4. Diagnosing and servicing the heating unit
    1. Interpretation of electrical and fuel system diagrams
    2. Operational characteristics and sequences of controls and components
    3. Remove, test, repair, and replace components
    4. Procedures for locating and remedying troubles
    5. Laboratory applications

Dishwashers

1. Installation procedures
    1. Location of power and water
    2. Location of proper drain
    3. Voltage, water pressure-temperature tests
    4. Leveling
    5. Grounding
    6. Instruction of user

2. Safety procedures	1. Grounding and wiring per local codes 2. Plumbing per local codes 3. Proper power, water, and drain connections 4. Disconnecting power before servicing
3. Operating procedures	1. Test run and time the operation 2. Instruction of user on proper usage of the appliance, detergents, etc.
4. Diagnosing and servicing the appliance	1. Interpretation of electrical, mechanical, and water diagrams 2. Operational characteristics and sequences of all systems 3. Functions of all components 4. Remove, test, repair, and replace the components 5. Procedures for locating problems 6. Laboratory applications

Food Waste Disposers

1. Installation procedures	1. Power supply and proper drain size and location 2. Proper sink adaptation
2. Safety precautions	1. Proper grounding per code 2. Plumbing and electrical per code 3. Accessible shut-off switch 4. Instruction of user in safe operation
3. Diagnosing and servicing the appliance	1. Operational characteristics 2. Functions of each component 3. Remove, test, repair, and replace components 4. Procedures for locating problems 5. Laboratory applications

Percolators, Toasters, Irons, and Grills

1. Safety procedures	1. Power requirements 2. Cords, shrouds, etc. 3. Servicing with power disconnected
2. Operating procedures	1. Test run and time the operation 2. Instruction of user on proper utilization of the appliance
3. Diagnosing and servicing the appliance	1. Interpretation of electrical diagrams 2. Operational characteristics and sequences 3. Functions of each component 4. Remove, test, repair or adjust, and replace components 5. Procedures for locating troubles 6. Laboratory applications

Mixers, Fans, and Vacuum Cleaners

1. Safety procedures	1. Power requirements 2. Cords, shrouds, etc. 3. Servicing with power disconnected
2. Operating procedures	1. Test run 2. Instruction of user on utilization of the appliance
3. Diagnosing and servicing	1. Operational characteristics 2. Functions of components 3. Remove, test, repair or adjust, and replace components 4. Procedures for locating troubles 5. Laboratory applications

CURRICULUM GUIDE

FOR THE

PROPOSED TWO-YEAR
APPLIANCE SERVICE
TECHNOLOGY PROGRAM

ENGLISH COMPOSITON I

A course in practical composition consisting of a review of the fundamentals of English, vocabulary building, summarizing, and the writing of simple themes. To help stimulate the improvement in diction and an interest in good literature and the reading of formal and informal essays is included.

Text: Morris, Walker, Bradshaw, Hodges, Whitten: College English-The First Year. New York: Harcourt, Brace and World, Inc. 1964.

or; Johnson, Schalekamp and Garrison: Communications. New York: McGraw-Hill Book Company. 1965.

Allied Materials:
Harbrace College Workbook. Harcourt, Brace and World, Inc. 1964.

or; Crowell: Modern English Workbook. New York: McGraw-Hill Book Company. 1965.

Audiovisual Materials:
No special materials.

Course Objectives:
To develop the student's appreciation for good writing; to help establish a "grammar sense" which should enable the student to detect, analyze, and rectify errors in effective reading and writing.

Means of Achieving Objectives:
Workbook exercises are a source of drill materials in grammar. Class discussion of these exercises and examples of good writing to aid in the development of the appreciation of good writing.

Impromptu class writings should be exercised. Also, themes related to current readings in literature, etc. are corrected and discussed with the student. An overall careful guidance by the instructor to attain the objectives established.

ENGLISH COMPOSITION II

A course designed as a continuation of English Composition I. The development of the student's appreciation for good writing is continued. Short stories, poetry, essays and drama are included as readings. The efficient use of the library is stressed with special emphasis on a required quality research paper.

Text: Morris, Walker, Bradshaw, Hodges, Whitten: College English-The First Year. New York: Harcourt, Brace and World, Inc. 1964.

or; Johnson, Schalekamp and Garrison: Communications. New York: McGraw-Hill Book Company. 1965.

Workbook and Allied Materials:

Crowell: Modern English Workbook. New York: McGraw-Hill Book Company. 1965.

or; Fuller and Wasell: Advanced English Exercises. New York: McGraw-Hill Book Company. 1965.

Baudin and Pfeiffer: Essays for Study: New York. McGraw-Hill Book Company. 1965.

Course Objectives:

To intensify the student's awareness of the quality and variety of human experience through reading and writing; to help enable the student to assimilate information and express himself in a meaningful and effective manner.

Means of Achieving Objectives:

Literary works, supplemented by lectures or genre, will provide material for recitation. Exercises in workbooks will provide experience with the rules of grammar, spelling and punctuation. Practice in the use of the library, outlining, gathering materials, and writing will be gained in thene work and the research paper.

Readings, analysis and discussion of literary works such as: (1) Hardy-"The Three Strangers"; (2) Conrad-"The Lagoon"; (3) Anderson-"Sophistication"; (4) Hemingway-"After the Storm"; and (5) Etc. will allow experiences in thought, analysis, vocabulary and spelling, etc.

SPEECH

A beginning course in speech dealing with the application of basic principles and practices of effective speaking in both formal and informal situations.

Text: Baird and Knower: General Speech. 3rd Edition. New York: McGraw-Hill Book Company. 1963.

Allied Materials:
Tapes and recordings of famous speeches.

Course Objectives:
To formulate an appreciation for, and an application of, the fundamentals of effective speaking in an informal or formal situation.

Means of Achieving Objectives:
A presentation and interpretation of the fundamentals of speech. Emphasis on speech organization, supporting materials, use of effective language, exercises in diction and practicum in speaking. Exercises in the basic and special speech types are employed.

POLITICAL SCIENCE

A study of the basis of our federal government, its origin and development, the drafting, adoption, and growth of the Constitution, civil liberties, and the organization, function and services performed.

Text: Carr, et al: American Democracy in Theory and Practice. National Government. 3rd Edition.

or, Gosnell, Lancaster, and Rankin: Fundamentals of American National Government. New York: McGraw-Hill Book Company. 1955.

Allied Materials:

An extensive reading list to acquaint the student with the history, formulation and operations of our national government.

Course Objectives:

To promote a better understanding of the historical background, formulation, structure and functions of the national government. To encourage the student to assume his share of the responsibility conferred upon the citizens of our Democracy. To encourage critical and creative thinking and analysis of political problems.

Means of Achieving Objectives:

Textbook and outside reading assignments, class discussions and lectures, conferences, analysis and discussion of current publications and political problems, field trips, tape recordings, etc.

PSYCHOLOGY

A course in the practical application of the principles of psychology to the individual, the group, the relationships between employees, and other aspects of the business and industrial scene.

Text: Maier, Norman F., Psychology in Industry; 2nd Edition, Boston: Houghton Mifflin Company. 1955.

or; Gilmer, Industrial Psychology, 2nd Edition. New York: McGraw-Hill Book Company. 1966.

Allied Materials:
Standardized tests, films, charts and graphs, and displays.

Course Objectives:
To introduce the student to the fundamentals of psychology that apply to the relationships and interactions commonly found in a business or industrial situation.

Means of Achieving Objectives:
Presentations, demonstrations, discussions, industrial resource personnel and field trips to emphasize and indicate (a) the role of psychology in business and industry; (b) causation in behavior; (c) the psychology of attitudes; (d) frustration-cause and effect; (e) morale; (f) supervisory leadership; (g) individual differences; (h) measuring proficiency; (i) the use of psychological tests in business and industry; (j) fatigue-effect; (k) labor-management relations; (l) attitudes and job satisfactions; (m) human factors in systems; (n) etc.

Lectures, class discussion, films, reports, field trips, business and industrial displays, as well as resource personnel from business and industry should be employed.

SALESMANSHIP

Principles of sales-force organization and operation, selling techniques, and the climate for personal and group selling should be emphasized in this course.

Text: Kirkpatrick, Salesmanship. Cincinnati: South-Western Publishing Company. 1961.

or; Pussell, Beach and Buskirk. Textbook of Salesmanship. New York: McGraw-Hill Book Company. 1963.

or; Canfield, Salesmanship. 3rd Edition. New York: McGraw-Hill Book Company. 1958.

Allied Materials:

Films and filmstrips available from many sources.

Course Objectives:

To create an appreciation for, and an understanding of, the need for the development of sales techniques and the climate for selling. The knowledge, skills, and attitudes necessary for selling and the sales process is stressed.

Means of Achieving Objectives:

Lectures, reports, student sales demonstrations, resource personnel lectures and demonstrations, panel and "busy" group activities, films and filmstrips, tests and individual conferences should help achieve the objectives of the course.

PRINCIPLES OF MANAGEMENT

The basic principles of management and organization in our modern business and industry should be stressed. Standards, methods, and problems in management should be included.

Text: Allen, Management and Organization. New York: McGraw-Hill Book Company. 1958.

or; Dale, Management. New York: McGraw-Hill Book Company. 1965.

Allied Materials:
Films and filmstrips.

Course Objectives:
The presentation and understanding of the basic principles of management, the framework of management, types of management, management functions, organizations, planning and forecasting, direction and control, innovation, and the process of decision-making should be stressed.

Means of Achieving Objectives:
Lectures, reports, resource personnel lectures and discussions, study of large and small organization structure, management and control, individual projects and conferences should be emphasized and should help achieve the objectives of the course.

BUSINESS LAW

The understanding of basic laws covering business transactions encountered in sales, real property and leases, partnerships and corporations should be stressed in this course.

Text: Corley and Black, The Legal Environment of Business. New York: McGraw-Hill Book Company. 1963.

Spencer and Gillam, A Textbook of Law and Business. New York: McGraw-Hill Book Company. 1952.

Spencer and Gillam, A Casebook of Law and Business. New York: McGraw-Hill Book Company. 1953.

Allied Materials:
Further casebooks in Business Law.

Course Objectives:
An introduction to the basic understanding by students of the legal regulations affecting the business or corporate organization. Basic regulations in sales, finance, contracts, warranties, negotiable instruments, insurance, etc. should be stressed.

Means of Achieving Objectives:
Lectures, case analysis, discussions, resource personnel lectures and analysis, student projects and conferences, etc.

ACCOUNTING

A study of accounting principles, the useful application of accounting methods in business and industry and analysis of financial statements, balance sheets are included in this course.

Text: Finney and Miller, Principles of Accounting. Prentice-Hall, Inc. Sixth Edition.

Meigs and Johnson, Accounting. New York: McGraw-Hill Book Company. 1966.

Allied Materials:
Accounting, worksheets, practice sets, etc.

Course Objectives:
To stress the significance of accounting in the business and industrial world, to promote an understanding of accounts, statements of position, trial balance, journalization and posting, control accounts, accounts receivables, fixed assets, payroll and payroll taxes, voucher systems, partnerships, corporations, bonds, and financial statements.

Means of Achieving Objectives:
Lectures, demonstrations, resource personnel, individual projects and assignments, accounting worksheet exercises, practice set exercises, etc.

TECHNICAL PHYSICS

A study of the fundamentals of physics and their applications to technology and industry. The topics of mechanics, heat, light and sound should be explored along with an introduction to electricity and magnetism. Two hours lecture and two hours laboratory.

Text: Harris, Applied Physics, Ann Arbor: University of Michigan.

or; Bueche, Principles of Physics. New York: McGraw-Hill Book Company. 1956.

Allied Materials:

Harris, Experiements in Applied Physics. New York: McGraw-Hill Book Company. 1963.

Films and filmstrips.

Physics laboratory equipment.

Course Objectives:

To derive an understanding and application of the basic laws of physics related to mechanics, heat, light, sound, and some in electricity and magnetism.

Means of Achieving Objectives:

Lectures, demonstrations, problem-solving, films and filmstrips, and basic student laboratory experiments through which some of the basic laws of physics and their applications to technology and appliance servicing can be understood as explored and applied.

TECHNICAL CHEMISTRY

A course emphasizing the fundamental principles, theories and problems of chemistry. A study of atomic structure, valence theory, ionization, energy and chemical changes, and the basic thermodynamics of chemistry should be presented.

Text: King and Caldwell, College Chemistry. New York: American Book Company.

or: Watt, Basic Concepts in Chemistry, New York: McGraw-Hill Book Company. 1958.

Allied Materials:
Films, filmstrips, transparencies, etc. and chemisty laboratory equipment.

Course Objectives:
To present the opportunity for the student to obtain sufficient background in atomic theory and structure, valence theory, bonding, solution equilibria, entropy, and basic thermodynamics of chemistry applicable to applied technologies.

Means of Achieving Objectives:
Lectures, demonstrations, student laboratory experiences, films, filmstrips, resource personnel, etc. through which some of the applicable principles and applications of chemistry can be understood and applied.

TECHNICAL MATHEMATICS

A course which includes a brief review of high school algebra, a study of linear equations of one and more unknowns, simultaneous equations, exponential and logarithmic functions and an introduction to trigonometric functions.

Text: Palmer and Bibb, Practical Mathematics. New York: McGraw-Hill Book Company. 1952.

or; Rice and Knight, Technical Mathematics with Calculus. New York: McGraw-Hill Book Company. 1965.

Course Objectives:

To make mathematics the technician's tool to applied fields of science and engineering.

Means of Achieving Objectives:

Lectures, visual aids, problem-solving in applications related to appliance servicing and the basic sciences.

ADVANCED TECHNICAL MATHEMATICS

A continuation of the study of algebraic and trigonometric functions, identities, inverse functions, logarithms and an introduction to analytic geometry and the calculus.

Text: Rice and Knight, Technical Mathematics with Calculus. New York: McGraw-Hill Book Company. 1965.

Palmer and Stout, Practical Calculus. New York: McGraw-Hill Book Company.

Allied Materials:
None.

Course Objectives:
To continue to build the mathematical background in practical, or applied, mathematics for the technician to assure better understanding of the overall science-related applications in his field.

Means of Achieving Objectives:
Problem-solving in algebra, trigonometry and calculus in the field of application in appliance servicing, design and manufacture. Lectures, conferences, individual projects, discussions and tests may be involved.

DRAWING

Usage of drawing instruments, lettering and freehand work is stressed. The study of orthographic projections and the general skills and techniques are pursued.

Text: French and Vierck, A Manual of Engineering Drawing for Students and Draftsmen. New York: McGraw-Hill Book Company. 1960.

or; Grant, Engineering Drawing. New York: McGraw-Hill Book Company, 1962.

or; Geisecke, Mitchell and Spencer, Technical Draving. New York: The McMillan Company.

Allied Materials:
Models, templates, lettering guides, transparencies, and films.

Course Objectives:
To provide the student with the fundamental drafting techniques, drawing experience, the ability to read schematics and blueprints, and to appreciate the latest dimensional methods, principles of projections, and conventional representations.

Means of Achieving Objectives:
Regular and special drawing assignments, commercial blueprints, experience with transparencies and ozalids, field trips to industrial firms, films, sketches and specific laboratory experiences in drawng.

FUNDAMENTALS OF ELECTRICITY

The course should include a study of the generation, transmission, and utilization of electrical energy in direct and alternating current. The fundamental principles and their applications in electrical circuits and apparatus as used in business and industry should be stressed.

Text: Adams, Electrical Principles and Practices. New York: McGraw-Hill Book Company. 1963.

Siskind, Electricity, New York: McGraw-Hill Book Company, 1955.

Suffern, Basic Electrical and Electronic Principles. New York: McGraw-Hill Book Company. 1962.

Shrader, Electronic Communication. New York: McGraw-Hill Book Company.

Henney and Richardson, Basic Electronics. New York: Rinehart and Company, Inc.

Allied Materials:

Varied laboratory equipment, films, slides, schematic drawings, etc.

Course Objectives:

To give the student an opportunity to learn the fundamentals of A.C. and D.C. from their origin through appliance, business and industrial applications.

Means of Achieving Objectives:

Lectures, demonstrations, resource personnel, laboratory experiences, visual aids, cutaways, motors and other operational units. Some of the presentations should include:

1. General introduction of electron theory, sources and production of electricity.

2. Energy and power dissipation.

3. Ohm's law and its relationships.

4. Principles of D.C. including varied circuitry, measurement and instrumentation.

5. Principles of A.C. including circuitry, measurements, inductance, capacitance, inductive reactance, capacitive reactance, impedance, etc.

6. Magnetism and electromagnetism.

7. Principles of motors, generators, etc.

8. Circuitry and laboratory experiences in D.C. and A.C. in single and polyphase. Power factors, etc.

ELECTRICITY-ELECTRONICS

A continuation of Fundamentals of Electricity with further study of electrical applications in Electronics. The study of basic vacuum and gaseous tube, semiconductors, rectifiers, etc., and their applications should be stressed.

Text: Shrader, Electronic Communications. New York: McGraw-Hill Book Company.

Grob, Basic Electronics. New York: McGraw-Hill Book Company.

Torman, Radio Engineer's Handbook. New York: McGraw-Hill Book Company.

Wilcox, Basic Electronics. New York: Rinehart and Conpany.

Others.

Allied Materials:
Films, demonstration equipment, tube manuals, transistor manuals, etc.

Course Objectives:
To introduce the fundamentals of electron tube and transistor theory and applications for the understanding of motor and appliance control.

Means of Achieving Objectives:
Lectures, demonstrations, problems, visual aids and laboratory experiences. The course should cover the elements of electronics some of which may be:

1. Theory and operation of vacuum tubes including diodes, triodes, tetrodes, pentodes, special tubes, etc.

2. Theory and applications of power supplies, amplifiers, etc.

3. Amplification factor and its application.

4. Theory and applications of solid-state devices.

5. Time delay circuitry, switching, sensing devices, etc.
6. Laboratory experiences in basic circuit analysis, etc.

MECHANISMS AND CONTROLS

A graphic and mathematicsl study of mechanical movements, including linkages, cams, gears and mechanical trains. Mechanisms and controls relating to appliances are stressed.

Text: Zimmerman, Elementary Kinematics of Mechanisms. New York: Wiley and Sons. 1962.

Service manuals from various manufacturers of appliances.

Allied Materials:
Films, pamphlets and cutaways.

Course Objectives:
To promote a basic understanding of diagnosis and design of varied mechanical and electrically operated mechanisms and controls particularly related to modern appliances.

Means of Achieving Objectives:
Lectures, problems and laboratory experiences in:

1. Linkages, cams, gears and gear trains.

2. Motion analysis.

3. Study and analysis of appliance mechanisms and controls.
   a. Motors
   b. Transmissions
   c. Timers
   d. Solenoids
   e. Heating elements and burners
   f. Compressors
   g. Fans and Blowers
   h. Pumps
   i. Switches
   j. Motor speed controls
   k. Electronic sensors
   l. Etc.

APPLIANCE SERVICING I

The study of design and operation of small appliances is stressed. Experiences in the diagnosis, service and repair of these appliances is also included.

Text: Brockwell, Small Appliance Servicing. New York: McGraw-Hill Book Company. 1957.

Service manuals from manufacturers.

Allied Materials:
Service Manuals, circuit diagrams, cutaways, etc.

Course Objectives:
To develop an understanding of the trouble diagnosis, service and repair of small appliances.

Means of Achieving Objectives:
Lectures, demonstrations and laboratory exercises in the testing, service and repair of small appliances which could include:

1. Irons
2. Sandwich grills
3. Rotisseries
4. Fans
5. Toasters
6. Percolators
7. Food Mixers
8. Vacuum Cleaners
9. Food waste disposers
10. Etc.

APPLIANCE SERVICING II

The study of design and operation of such major appliances as washers, dryers, ice machines, water heaters, dish washers, and ranges. Experiences in installation, diagnosis, service, and repair are stressed.

Text: Brockwell, Major Appliance Servicing. New York: McGraw-Hill Book Company. 1958.

Service Manuals from manufacturers.

Allied Materials:

Films, service manuals, circuit diagrams, laboratory space and equipment, cutaways, etc.

Course Objectives:

To adequately train the student to install, diagnose, service and repair the major appliances such as washers, dryers, ice machines, water heaters, dish washers, and ranges.

Means of Achieving Objectives:

Lectures, demonstrations and laboratory exercises in the installation, diagnosis, service and repair of major appliances. The study and experiences could include:

1. Installation procedures.
2. Safety procedures.
3. Operating procedures.
4. Diagnosing and servicing the electrical, mechanical fuel and water systems.
5. Testing.

APPLIANCE SERVICING III

The study of design and operation of such major appliances as refrigerators-freezers, air conditioners and heating systems. Experiences in installation, diagnosis, service and repair are stressed.

Text: Brockwell, Major Appliance Servicing, New York: McGraw-Hill Book Company. 1958.

Service Manuals from manufacturers.

Allied Materials:

Reference materials in venting, thermodynamics and power. Films and laboratory equipment.

Course Objectives:

To adequately train students to install diagnose, service and repair refrigerators-freezers, air conditioners, and heating systems.

Means of Achieving Objectives:

Lectures, demonstrations, and laboratory experiences in the installation, diagnosis, service and repair of major appliances. The study and experiences could include:

1. Installation procedures including power and fuel requirements.
2. Safety precautions including proper wire sizing, fuel supply and volume, operation of 100% safety shut-off controls, and fire regulations.
3. Diagnosing and servicing the system or individual units within the system.
4. Repair of the system or individual units within the system.
5. Testing operation of repaired unit.

APPENDIX B

SUGGESTED EQUIPMENT LIST FOR AN APPLIANCE SERVICE TECHNOLOGY PROGRAM

Appliance Service Laboratory
(for 20 students)

Item	Quantity
Refrigerators	5
Freezers	3
Room air conditioners	3
Central system air conditioners	2
Heating systems (gas and/or oil)	2
Space heaters	2
Washers (clothes-conventional and automatic)	6
Dryers (clothes)	6
Ironers	2
Ranges (electric and gas)	4
Water heaters	3
Dishwashers	3
Food waste disposers	4
Vacuum cleaners	4
Fans	6
Mixers	4
Coffee Makers	4
Irons	6
Grills	4
Dehumidifiers	3
Humidifiers	3
Water coolers	3

Student Station Equipment

Item	Quantity
Work Bench (with storage drawers, etc.)	20
Stools	20
Soldering gun	20
*Hand Tool Sets	20
Work Lamp	20
Aprons	20
Safety glasses	20
Bench Vise	20

*Hand Tool Sets

Tool Box	1
Socket set (1/4" drive-3/8"-5/8")	1
Screw driver set (1"-8")	1
Screw driver set (Phillips)	1
Needel nose pliers	1
Diagonal cutters (6")	1
Diagonal cutters (4")	1
Adjustable wrenches (4", 6", and 8")	1 each
Pliers	1
Open end wrench set (3/16"-7/8"	1
Box end wrench set (3/8"-1")	1
Hammer	1
Punch set	1
Chisel set	1
Files (round and flat)	1 set
Steel rule	1
Scribe	1
Allen wrench set	1
Nut driver set	1
Shears (Metal)	1

Equipment List (cont'd)

Allied Equipment

Item	Quantity
Grinder-Buffer	1
Arbor Press	1
Drill Press and Vises	1
Lathe and accessories	1
Cleaning tanks	2
Electric drills (1/2")	2
Electric drills (3/8" and 1/4")	6
Air compressor	1
Arc welder	1
Gas welder with cutting heads	2
Anvils	2
Large machinist vise	2
Pipe vise	2
Riveting Machine	1
Spot welder	1
Appliance hand truck	2
Appliance dolly	6
Adjustable wrenches 18"	6
Adjustable wrenches 15"	6
Pipe wrenches 14" and 18"	6
Master puller set	1
Drill sets	2
Soldering iron	4
Socket set (1/2" drive - 7/16"-1 1/4")	3
Terminal Connector set	6
Hammers (ball pein)	6

Test Equipment

Item	Quantity
Refrigerant leak detector	2
Refrigerant manifolds with gauges and hoses	10
Temperature Recorder	3
Refrigeration thermometers	6
Oven thermometers	10
Capacitance checker	2
Resistance boxes	2
Manometers	6
Volt-ohm meters	10
Watt meters	4
Ammeters	6
Oscilloscope	1
Multitester	6
Levels	4

Classroom Equipment

Work Tables (2 1/2' x 3' per student)
Chairs
Instructor's Demonstration Table
Chalkboard (16' to 24')
Storage Cabinets
Motion Picture Projector and Stand
Opague Projector
Slide Project
Screen
Cutaways
Equipment molds
Reference Materials
Chalk, pointers, etc.
Demonstration equipment

In addition to the aforementioned equipment there should be provisions for tool storage, proper appliance connections, special tool sets to repair specific appliances (seal pullers, bearing removers, etc.) and the supplies too numerous to mention.

All materials and equipment for the instruction and laboratory experiences for Physics and Chemistry have been excluded.

APPENDIX C

Information Relative To A Proposed
APPLIANCE SERVICE TECHNOLOGY PROGRAM
At
Lake Michigan College

Please indicate below your interests or comments relative to a proposed Appliance Service Technology Program at Lake Michigan College and return the completed form to Dr. C. H. Schauer, Dean of Community Services at Lake Michigan College, 711 Britain Avenue, Benton Harbor, Michigan. The source of individual comments will be considered confidential.

I. We now employ Appliance Service Technicians.

☐ Yes
☐ No

A. They are employed as:

☐ Laboratory technicians
☐ Product design change analysts
☐ In manufacturing processes
☐ Sales personnel
☐ Production employees
☐ Other: ______________________________(specify)

II. Educational requirements for employment as an Appliance Technician are:

☐ Less than high school graduate
☐ Less than high school graduate plus special training and skills
☐ High school graduate
☐ High school graduate plus special training and skills
☐ Two years of college
☐ Two-year community college associate degree in technology
☐ College graduate
☐ Other: ______________________________(specify)

III. We would employ a Technician with training beyond high school as outlined in the attached proposed Appliance Service Technology Program.

( ) Yes
( ) No

IV. Suggestions or comments on the attached proposed Appliance Service Technology Program:

____

____

____

V. We would help establish and operate the proposed Program by providing:

( ) New, or used, appliances and/or components for laboratory instruction and student manipulation
( ) Instructional aids (cut-aways, charts, flow and wiring diagrams, etc.)
( ) New, or used, appliances for instructional and demonstration purposes
( ) Monetary grants
( ) Specialized personnel for consultation
( ) Students or recruitment of students
( ) Other: __________________________(specify)

SIGNED: ______________________________ (Name)

______________________________ (Company)

______________________________ (Address)

______________________________ (City & State)

Information Relative To A Possible
APPLIANCE SERVICE TECHNOLOGY PROGRAM
At
Lake Michigan College

Please indicate below your interests, comments, and estimations relative to a possible program for Appliance Service Technicians and return the completed form to Dr. C. H. Schauer, Dean of Community Services at Lake Michigan College, 711 Britain Avenue, Benton Harbor, Michigan. The source of individual answers and comments will be considered confidential.

I. We now employ ________ Appliance Service Technicians.
(number)

II. We would employ Appliance Service Technicians as trained in the attached proposed Training Program.

( ) Yes
( ) No

A. If yes, we anticipate the need in our organization for such Technicians to be:

______________by 1966
______________by 1967
______________by 1968
______________by 1972

B. The reason for these needs is due to:

( ) Replacement
( ) New employment and utilization
( ) Expansion of our organization

III. We would employ the trained Technician as:

( ) Appliance serviceman
( ) Appliance service supervisor
( ) Shop-based repairman
( ) Salesman
( ) Office supervisor
( ) Other: ________________________________(specify)

IV. We consider the personal characteristics of a potential Appliance Service Technician employee to be:

A. Age: _____to_____

B. Sex: ( ) Male ( ) Female ( ) Either male or female

C. Physical health and conditions

( ) Perfect health and ambulation
( ) Partial handicap
( ) Other: ____

____ (specify)

V. Suggestions or comments on the attached proposed Appliance Service Technology Program:

____

____

____

VI. We would send employees for training.

( ) Yes
( ) No

A. If yes, we would send these employees on:

( ) Full-time basis (expenses paid)
( ) Full-time-released basis
( ) Other: ______________________________ (specify)

B. The number that would, or could, be sent for training is:

__________in 1966-67
__________in 1967-68
__________in 1968-69

VII. We would be willing to help Lake Michigan College initiate and operate the Program.

( ) Yes
( ) No

A. Support would be:

( ) Used, or new, equipment or components for instructional and laboratory purposes
( ) Instructional aids (charts, cut-aways, etc.)
( ) New, or used, appliances for instructional demonstrations
( ) Personnel for consultative services
( ) Monetary grants
( ) Recruitment of students
( ) Other:______________________________(specify)

SIGNED: ______________________________(Name)

______________________________(Position or Title)

______________________________(Company)

______________________________(Address)

______________________________(City & State)

APPENDIX D

APPLIANCE SERVICE TECHNOLOGY ADVISORY COMMITTEE

G & M Appliances Jack Curtis, Service Manager	Niles, Michigan
Indiana & Michigan Electric Company H. K. Morris, Personnel Walt Appleget, Div. Service Coordinator	Benton Harbor, Michigan
Maytag Company Bill Benson, Service Supervisor	Newton, Iowa Grand Rapids, Michigan
Michigan Gas Utilities Company Gene Lewis, Manager	Benton Harbor, Michigan
Patton Brothers Louis Patton	Benton Harbor, Michigan
Radio Equipment Company Jack Andrews	South Bend, Indiana
Sears, Roebuck & Company Paul Kirchner, Customer Service Manager Judson Marche, Assistant Store Manager	Benton Harbor, Michigan
West Michigan Electric Company Bruce Radenbaugh, Service Manager	Benton Harbor, Michigan
Whirlpool Corporation Ted Miller, St. Joseph Division (Personnel) Vince Miller, Educational Division	Benton Harbor-St. Joseph, Michigan

MANUFACTURERS

Mr. E. L. Vervoort, Chairman
Customer Service Committee
American Gas Association
195 Montague Street
Brooklyn, New York 11201

Mr. Herbert Phillips
Technical Director
American Home Laundry Manufacturers' Association
20 North Wacker Drive
Chicago, Illinois 60606

Mr. E. C. Carman
Director of Marketing
Avco Corporation
Aerospace Structures Division
Nashville, Tennessee 37202

Mr. Robert S. Geran
General Service Manager
American Motors Corporation
14250 Plymouth Road
Detroit, Michigan 48232

Mr. Stephen Upton
Vice President, Consumers Service
Whirlpool Corporation
Administrative Center
Benton Harbor, Michigan

Mr. L. O. Reese, President
Armstrong Products Corporation
P. O. Box 940
Huntington, West Virginia

Mr. E. B. Lawson, Manager
Service Department, Appliance Division
Blackstone Corporation
Jamestown, New York 14701

Mr. Thomas Scheirlow, Service Manager
Delco Products Division
General Motors Corporation
329 E. First Street
Dayton 1, Ohio

Mr. K. W. Bennett, General Supervisor
Service Training Department
Frigidaire
Dayton, Ohio 45401

Mr. A. F. Horn
General Electric Company
Building 6, Room 218
Appliance Park
Louisville 1, Kentucky

Mr. D. G. Kassner
Product Service Manager
Hamilton Manufacturing Company
Two Rivers, Wisconsin

Mr. W. G. McNeal, Manager
Product Service
Hotpoint
5600 West Taylor Street
Chicago, Illinois 60644

Mr. E. G. Davidson
Supervisor-Service Training
Norge Sales Corporation
National Service Department
Merchandise Mart Plaza
Chicago, Illinois 60654

Mr. Alex J. Tagnon
Field Service Manager
Philco Corporation
Parts & Service Department
"C" and Westmoreland Streets
Philadelphia, Pennsylvania 19134

Mr. M. Bartelt
Service Department
Speed Queen
Ripon, Wisconsin 54971

Mr. W. B. Creech
General Manager, Product Service
Westinghouse Electric Corporation
246 Fourth Street, East
Mansfield, Ohio 44902

Mr. Fran Susor, Manager
Service Training
The Maytag Company
Newton, Iowa 50208

Mr. Lloyd W. Sleezer
Easy Appliance Division
Hupp Corporation
1135 Ivanhoe Road
Cleveland, Ohio 44110

Mr. C. T. McClure
Franklin Appliance Division
Studebaker Corporation
65 22nd Avenue, N.E.
Minneapolis, Minnesota 55418